CLAIMS

What is claimed is:

1. A method comprising:

measuring phase noise in a signal, the phase noise due to a sampling-time phase mismatch between a transmitter device and a receiver device;

determining a Gaussian noise power level in the signal;

calculating a gain factor associated with the phase noise; and

applying the gain factor to the Gaussian noise power level to calculate an equivalent noise power.

2. The method of claim 1, further comprising:

determining a signal-to-noise ratio based on a signal power of the signal and the calculated equivalent noise power.

3. The method of claim 1, wherein the signal is a multicarrier signal including a plurality of sub-carriers.

4. The method of claim 3, wherein determining the Gaussian noise power level in the signal comprises:

determining a total noise power level in the signal;

determining a phase noise power level in the signal; and

subtracting the phase noise power level from the total noise power level to determine the Gaussian noise power level in the signal.

5. The method of claim 4, wherein the phase noise power level of a first sub-carrier is based on an average power of a timing phase error in a phase error measurement sub-carrier and a ratio of a frequency of the first sub-carrier and a frequency of the phase error measurement sub-carrier.

6. The method of claim 5, wherein the phase error measurement sub-carrier is a pilot-tone.

7. The method of claim 5, wherein the phase noise power level of the first sub-carrier is calculated as $\overline{\theta^2}\frac{f^2}{f_p^2}\overline{r^2}$, where $\overline{\theta^2}$ is the average power of the timing phase error in the phase error measurement sub-carrier, f is a frequency of the first sub-carrier, f_p is a frequency of the phase error measurement sub-carrier, and $\overline{r^2}$ is the average signal power of the first sub-carrier.

8. The method of claim 7, wherein the gain factor, G_P, is calculated as $G_P = 1 + \frac{2}{\alpha\sigma} r_{\max} \frac{f}{f_p} \theta_{\max}$, where α is a constant factor based on an error rate and a sub-carrier coding scheme, σ^2 is the Gaussian noise power level of the signal, $r_{\max}$ is a maximum distance of an error constellation point from an origin, and $\theta_{\max}$ is a maximum phase error.

9. The method of claim 8, wherein the equivalent noise power, σ_e^2 , for the first sub-carrier is calculated as $\sigma_e^2=\sigma^2 G_P^2$ ..

10. The method of claim 2, further comprising determining bit-loading based on the signal-to-noise ratio.

11. The method of claim 2, further comprising determining a bit-error rate based on the equivalent noise power.

12. The method of claim 3, further comprising:

determining a first gain factor and a first equivalent noise power for a first sub-carrier; and

determining a second gain factor and a second equivalent noise power for a second sub-carrier.

13. The method of claim 1, further comprising:

activating phase noise compensation based on a first threshold; and

deactivating phase noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.

14. A machine-readable medium storing executable instructions to a cause a device to perform a method comprising:

measuring phase noise in a signal, the phase noise due to a sampling-time phase mismatch between a transmitter device and a receiver device;

determining a Gaussian noise power level in the signal;

calculating a gain factor associated with the phase noise; and

applying the gain factor to the Gaussian noise power level to calculate an equivalent noise power.

15. The machine-readable medium of claim 14, wherein the method further comprises:

determining a signal-to-noise ratio based on a signal power of the signal and the calculated equivalent noise power.

16. The machine-readable medium of claim 14, wherein the signal is a multicarrier signal including a plurality of sub-carriers.

17. The machine-readable medium of claim 16, wherein determining the Gaussian noise power level in the signal comprises:

determining a total noise power level in the signal;

determining a phase noise power level in the signal; and

subtracting the phase noise power level from the total noise power level to determine the Gaussian noise power level in the signal.

18. The machine-readable medium of claim 17, wherein the phase noise power level of a first sub-carrier is based on an average power of a timing phase error in a phase error measurement sub-carrier and a ratio of a frequency of the first sub-carrier and a frequency of the phase error measurement sub-carrier.

19. The machine-readable medium of claim 18, wherein the phase error measurement sub-carrier is a pilot-tone.

20. The machine-readable medium of claim 18, wherein the phase noise power level of the first sub-carrier is calculated as $\overline{\theta^2}\frac{f^2}{f_p^2}\overline{r^2}$, where $\overline{\theta^2}$ is the average power of the timing phase error in the phase error measurement sub-carrier, f is a frequency of the first sub-carrier, f_p is a frequency of the phase error measurement sub-carrier, and $\overline{r^2}$ is the average signal power of the first sub-carrier.

21. The machine-readable medium of claim 20, wherein the gain factor, G_P, is calculated as $G_P = 1 + \frac{2}{\alpha\sigma} r_{\max} \frac{f}{f_p} \theta_{\max}$, where α is a constant factor based on an error rate and a sub-carrier coding scheme, σ^2 is the Gaussian noise power level of the signal, $r_{\max}$ is a maximum distance of an error constellation point from an origin, and $\theta_{\max}$ is a maximum phase error.

22. The machine-readable medium of claim 21, wherein the equivalent noise power, σ_e^2 , for the first sub-carrier is calculated as $\sigma_e^2 = \sigma^2 G_P^2$.

23. The machine-readable medium of claim 15, wherein the method further comprises determining bit-loading based on the signal-to-noise ratio.

24. The machine-readable medium of claim 15, wherein the method further comprises determining a bit-error rate based on the equivalent noise power.

25. The machine-readable medium of claim 16, wherein the method further comprises:

determining a first gain factor and a first equivalent noise power for a first sub-carrier; and

determining a second gain factor and a second equivalent noise power for a second sub-carrier.

26. The machine-readable medium of claim 14, wherein the method further comprises

activating phase noise compensation based on a first threshold; and

deactivating phase noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.

27. An apparatus comprising:

means for measuring phase noise in a signal, the phase noise due to a sampling-time phase mismatch between a transmitter device and a receiver device;

means for determining a Gaussian noise power level in the signal;

means for calculating a gain factor associated with the phase noise; and

means for applying the gain factor to the Gaussian noise power level to calculate an equivalent noise power.

28. The apparatus of claim 27, further comprising:

means for determining a signal-to-noise ratio based on a signal power of the signal and the calculated equivalent noise power.

29. The apparatus of claim 27, wherein the signal is a multicarrier signal including a plurality of sub-carriers.

30. The apparatus of claim 29, wherein the means for determining the Gaussian noise power level in the signal comprises:

means for determining a total noise power level in the signal;

means for determining a phase noise power level in the signal; and

means for subtracting the phase noise power level from the total noise power level to determine the Gaussian noise power level in the signal.

31. The apparatus of claim 30, wherein the phase noise power level of a first sub-carrier is based on an average power of a timing phase error in a phase error

measurement sub-carrier and a ratio of a frequency of the first sub-carrier and a frequency of the phase error measurement sub-carrier.

32. The apparatus of claim 31, wherein the phase error measurement sub-carrier is a pilot-tone.

33. The apparatus of claim 31, wherein the gain factor, G_P, associated with a first sub-carrier is calculated as $G_P = 1 + \frac{2}{\alpha\sigma} r_{\max} \frac{f}{f_p} \theta_{\max}$, where α is a constant factor based on an error rate and a sub-carrier coding scheme, σ^2 is the Gaussian noise power level of the signal, $r_{\max}$ is a maximum distance of an error constellation point from an origin, f is a frequency of the first sub-carrier, f_p is a frequency of a phase error measurement sub-carrier, and $\theta_{\max}$ is a maximum phase error.

34. The apparatus of claim 28, further comprising means for determining bit-loading based on the signal-to-noise ratio.

35. The apparatus of claim 28, further comprising means for determining a bit-error rate based on the equivalent noise power.

36. The apparatus of claim 29, further comprising:

means for determining a first gain factor and a first equivalent noise power for a first sub-carrier; and

means for determining a second gain factor and a second equivalent noise power for a second sub-carrier.

37. The apparatus of claim 29, further comprising:

activating phase noise compensation based on a first threshold; and

deactivating phase noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.

38. A Digital Subscriber Line (DSL) modem comprising:

a timing recovery module to measure a timing phase error within a signal, the timing phase error due to a sampling-time phase mismatch between a transmitter device and the DSL modem;

a phase noise power module to determine a phase noise power level of the signal, the phase noise power level based on the timing phase error;

a total noise power measurement module to measure a total noise power level of the signal, wherein a Gaussian noise power level of the signal is represented as the difference between the phase noise power level and the total noise power level; and

a gain factor module to calculate a gain factor associated with the timing phase error and to apply the gain factor to the Gaussian noise power level in the signal to calculate an equivalent noise power.

39. The DSL modem of claim 38, further comprising:

a signal power measurement module to measure a signal power level of the signal; and

a signal-to-noise power module to determine a signal-to-noise ratio (SNR) based on the signal power level and the calculated equivalent noise power.

40. The DSL modem of claim 39, further comprising:

a bit-loading module to determine bit-loading based on the signal-to-noise ratio.

41. The DSL modem of claim 40, wherein the signal is a multicarrier signal including a plurality of sub-carriers.

42. The DSL modem of claim 41, wherein the timing phase error is measured from a pilot-tone of the multicarrier signal.

43. The DSL modem of claim 41, wherein the gain factor, G_P, associated with a first sub-carrier is calculated as $G_P = 1 + \frac{2}{\alpha\sigma} r_{\max} \frac{f}{f_p} \theta_{\max}$, where α is a constant factor based on an error rate and a sub-carrier coding scheme, σ^2 is the Gaussian noise power level of the signal, $r_{\max}$ is a maximum distance of an error constellation point from an origin, f is a frequency of the first sub-carrier, f_p is a frequency of a phase error measurement sub-carrier, and $\theta_{\max}$ is a maximum phase error.

44. The DSL modem of claim 38, wherein the gain factor module is further to activate phase noise compensation based on a first threshold and deactivate phase noise compensation based on a second threshold, wherein the first threshold is greater than the second threshold.